5.0 Conclusions

The findings resulting from the air quality monitoring were:

- The pollution sources that affect Corpus Christi monitors were often local emission sources, including sources located within a few hundred feet from some sites. Other times the sources were the large industrial sources and ships within Nueces County. Finally there is evidence that emissions sources outside the region, including emissions from the Eagle Ford oil and gas production region, may have added to measured concentrations, particularly after 2012.

- Benzene concentrations at the two project monitoring sites, in residential areas, which made hourly measurements of individual hydrocarbons (Solar Estates and Oak Park), declined after the first three years of the project and had relatively little variation over the subsequent eight years. The highest concentrations were observed at times when the sites were downwind of the refinery area.

- Concentrations of hydrocarbons at the residential monitoring sites that made hourly measurements of hydrocarbons have on rare occasions exceeded odor threshold air monitoring comparison values (AMCV) established by the Texas Commission on Environmental Quality (TCEQ), but have not exceeded any health AMCV. Concentrations of hydrocarbons have on rare occasions exceeded the TCEQ short-term AMCV, but not since 2007.

- There has been a general downward trend in mean concentrations for most hydrocarbon species at the residential monitoring sites that made hourly measurements of hydrocarbons (Oak Park and Solar Estates); however, the downward trend for several low-molecular weight low-reactivity alkane species was reversed around 2012, followed by a decline in 2015. These changes are hypothesized to be related to changes in natural gas extraction activities, largely in regions north of Corpus Christi.

- At one of the residential monitoring sites that made hourly measurements of hydrocarbons (Solar Estates), concentrations of 1,3-butadiene, significantly above background levels, were observed under southwesterly winds until late 2009. Around late 2009, major process changes were made at an industrial chemical facility three miles southwest of the Solar Estates site, and concentrations of 1,3-butadiene returned to background levels. Because winds from the southwest are infrequent, the exact date of the change is difficult to determine.

- Sulfur dioxide concentrations decreased significantly since the project began. One site, the J. I. Hailey CAMS 630 site located near the port, measured concentrations that did not comply with the U.S. Environmental Protection Agency (EPA) 2010 National Ambient Air Quality Standards (NAAQS) for sulfur dioxide until 2013. Emissions from ships at docks were shown to have been a likely source of the SO_2, affecting the CAMS 630 site and several other monitoring sites. During the project, environmental regulations were implemented that required reduced sulfur content in ship fuel. After the implementation of the regulations, ambient SO_2 concentrations decreased.

- At two of the monitoring sites (Solar Estates and FHR Easement), an unknown SO_2 interferent was detected periodically. The last observed instance of this SO_2 interferent was December 2013. An experiment showed that the interferent affected different SO_2 instruments differently, but the actual interferent chemical was not identified.

- Hydrogen sulfide monitoring showed decreased concentrations over time at some sites but not others. Three project sites and one TCEQ site measured occasional H_2S concentrations exceeding TCEQ 80 ppb rolling 30-minute standard over the course of the project. The last exceedance observed by the network was in 2012.

Key findings from the air dispersion modeling were:

- AERMOD and CALPUFF replicated observed seasonal and locational differences in benzene concentrations, with increases in fall/winter relative to spring/summer at the residential monitoring sites (Solar Estates and Oak Park). Higher observed concentrations during the fall/winter than spring/summer were associated with more frequent northwesterly clockwise through northeasterly winds.

- Observed maximum benzene concentration at Oak Park were under-predicted by both models. This result may be associated with non-routine emissions not necessarily represented in the emission inventory.

- Observed benzene concentrations declined at Oak Park and Solar Estates between 2006 and 2008. These trends are consistent with declines in annual benzene emissions reported in the Toxics Release Inventory (TRI).

- Comparisons of modeled to observed 1,3-butadiene concentrations at Oak Park and Solar Estates during 2006 indicated a strong under-prediction bias by both models. This finding suggested that emissions of 1,3-butadiene could be missing from or under-reported in the emission inventories evaluated in this project. The potential for missing industrial emissions information was particularly pronounced near Solar Estates.

- Spatial maps of predicted mean, percentile, and maximum concentrations of benzene (e.g., Figure 5-1, page 5-3) and 1,3-butadiene (e.g., Figure 5-2, page 5-3) were developed to allow air toxics concentrations to be estimated in areas without monitoring sites. Maps of predicted benzene concentrations during 2006 were generally similar for both models. The locations of the Oak Park and Solar Estates monitors (shown as green dots in the Figures) were in regions with high predicted concentrations of benzene and 1,3-butadiene.

Figure 5-1. Predicted annual mean benzene concentrations in the receptor grid (colored area) from AERMOD (left) and CALPUFF (right) for 2006. Property boundaries of the stationary point sources are shown in gray.

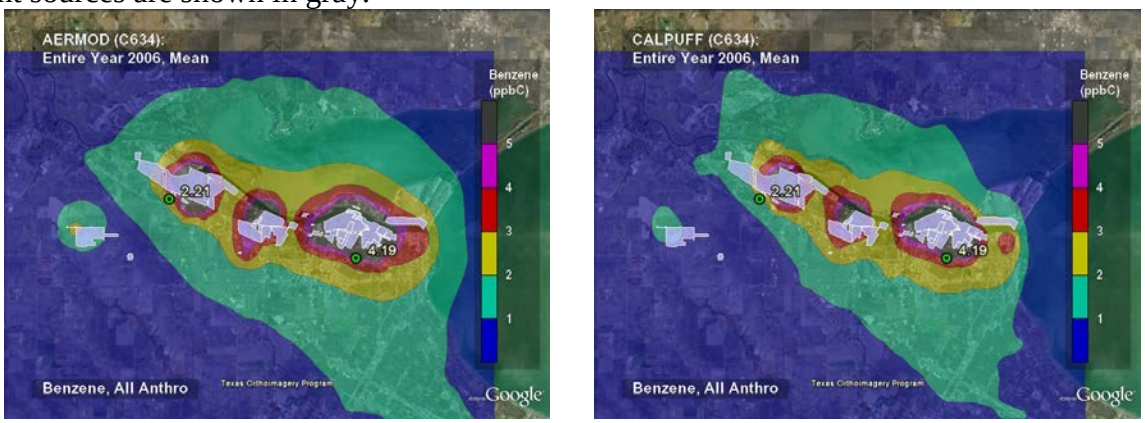
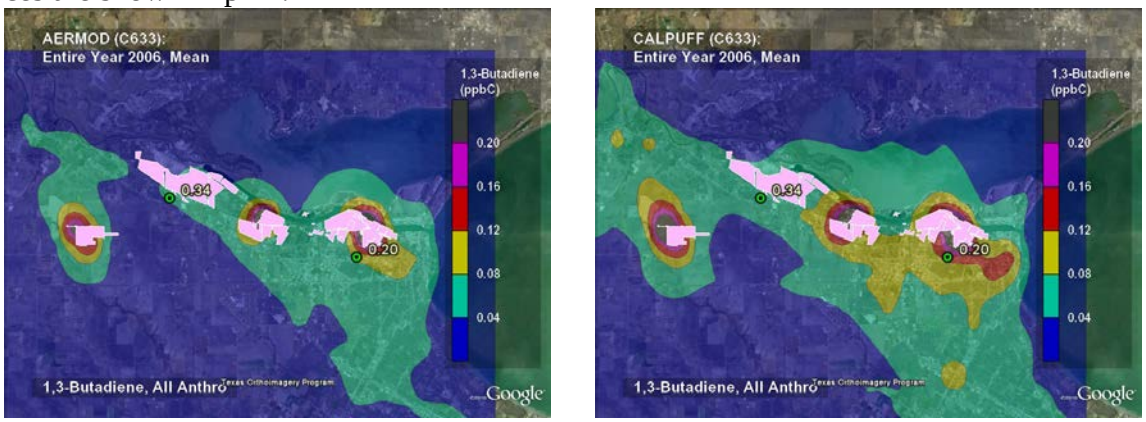
Figure 5-2. Predicted annual mean 1,3-butadiene concentrations in the receptor grid (colored area) from AERMOD (left) and CALPUFF (right) for 2006 using on-site meteorological data from the Solar Estates (C633) monitor for AERMOD. Property boundaries of the stationary point sources are shown in pink.